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AUTHOR Fieber, Nancy M.
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ABSTRACT

The paper reviews cognitive development during the sensorimotor period (approximately the first two years of life) and considers approaches to assessing multihandicapped, deaf-blind, or severely/profoundly retarded students functioning at this level. Evaluation and training of basic sensorimotor schemes (visual fixation and tracking, sucking, and grasp reflexes) are described, as are approaches to teaching the child to coordinate the basic schemes. The bulk of the manual is composed of detailed suggestions for administering the Sensorimotor Cognitive Assessment Scale, which is based on works of I. Uzgiris and J. Hunt. Each subscale is considered separately with suggestions of adaptations for sensory and motor impairments and examples of curriculum at lower levels. The seven subscales are: visual pursuit, localization, and the permanence of objects; means for obtaining desired environmental events; development of operational causality; construction of object relations in space; development of vocal imitation; development of motor (gestural) imitation; and development of schemes for relating to objects. Appended material includes examples of recordkeeping using the assessment procedure. (CL)

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SENSORIMOTOR COGNITIVE ASSESSMENT AND CURRICULUM FOR THE MULTIHANDICAPPED CHILD

Nancy M. Fieber, R.P.T., M.A.

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SENSORIMOTOR COGNITIVE ASSESSMENT AND CURRICULUM

FOR THE MULTIHANDICAPPED CHILD

Nancy M. Fieber, R.P.T., M.A., N.D.T.
Assistant Professor Allied Health and Pediatrics
Infant Development Program
Meyer Children's Rehabilitation Institute

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SENSORIMOTOR COGNITIVE ASSESSMENT AND CURRICULUM FOR THE MULTIHANDICAPPED CHILD

Nancy M. Fieber, M.A., R.P.T., N.D.T.
University of Nebraska Medical Center

The purpose of this presentation is to acquaint teachers of students who are multihandicapped, deaf-blind, or severely/profoundly retarded, with assessment of very early cognitive behaviors and implications for curriculum. We will be concerned with the sensorimotor period of cognitive development, roughly equivalent to the first two years of life. Cognitive development is defined for this purpose as concepts, reasoning ability, and mental representation. This mental representation is pre-requisite to symbolic thought and language development.

The assessment presented is that being utilized in the Infant Development and Deaf/Blind Programs at the Meyer Children's Rehabilitation Institute, Omaha, Nebraska, under the direction of Cordelia Robinson, Ph.D. It is derived from the work of Uzgiris and Hunt (1966; 1975) and Escalona (undated paper), based on the work of Piaget (1952; 1954), and adapted for our population by Dr. Robinson. This assessment is applicable regardless of age if the child is functioning at a sensorimotor level. Because the scales are ordinal, not normative milestones, they are designed in terms of the sequences in which concepts develop in several relatively independent cognitive areas. They are written as observable, measurable behaviors which demonstrate concept levels, and are useful as a measure of child progress, in program evaluation, and in development of prescriptive curriculum for an individual child.

The subscales included in the Sensorimotor Cognitive Assessment are: 1) Visual Pursuit, Localization and Object Permanence; 2) Development of

Means for Obtaining Desired Environmental Events; 3) Development of Operational Causality; 4) Development of Motor Imitation; 5) Development of Vocal Imitation; 6) The Construction of Object Relations in Space; and 7) The Development of Schemes for Relating to Objects.

The criterion behaviors listed were derived for children with intact sensory and motor abilities and are quite visual in emphasis; therefore, methods of task presentation and response may need adapting for children with sensory or motor handicaps. The work of Else Hauessermann (1958) has been a valuable source of adapted testing strategies and philosophy. Strategies and curriculum substeps often need to be individually developed because of varied combinations of handicaps, and we are slowly developing and validating curriculum, learning as we go along. We will describe some examples of task adaptations and of curriculum for some of the most severely handicapped children at the very beginnings of cognitive development, which may be of some immediate practical assistance to teachers.

Because motor handicaps are so visible, their effect on a child's total development may be more fully appreciated by a teacher, and motor management often plays a major role in the child's educational program. We will be concerned with the difficulties in sorting out mental and motor factors, and the importance of designing activities for both areas. The child will not always be able to respond optimally to instructional level cognitive tasks and instructional level motor tasks at the same time. Research with the development of attention in infants by Wolff (1973) supports this common sense approach.

The child's sensory handicaps probably have a greater impact on ability to learn, yet these are often undiagnosed or uncorrected. The impact of even a mild sensory deficit is greater in multihandicapped children, because they do not have the compensatory abilities of the otherwise normal hearing impaired or visually impaired child. For example, the "normal" blind child

must learn to make meaning of what he hears through associations with direct experiences. When a blind child is motor handicapped, experiences are severely limited also, and it is very difficult to make meaning of environment and language. Meaning will depend on correlating or associating information from two or more sensory channels. For this reason the development of any residual vision or hearing potentially available to a child is critical, and curriculum is developed for functional vision and hearing training as well as cognitive goals. Persistence in seeking adequate diagnosis and treatment for these problems is also needed.

Basic Schemes

With a severely/profoundly handicapped population we may need to begin with assessment and curriculum for the basic sensorimotor schemes normally present at birth -- abilities for visual fixation and tracking, sucking, and grasp reflexes. As these behaviors come under voluntary control they are the beginnings of cognitive development. The normal newborn also shows the beginnings of pattern and form discrimination in his preferential looking at stimuli such as black and white checkerboards or facial configurations. Although less well organized, auditory stimuli elicit alerting or listening responses. Severely handicapped children may lack these basic ways to deal with environment, and the ways to compensate for deficits.

Visual schemes In our population we have children whose abnormal motor patterns and seizure activity interact with central or peripheral visual system problems to prevent the organization of the basic visual behaviors. These children may be unable to fixate or track, or labelled as cortically blind. Severe oculomotor system problems occur such as strong deviation of eyes in one direction, with associated abnormal tonic reflex activity of the whole body. Primitive compensatory eye movements opposite direction of head movement (Doll's Eyes Phenomenon), may be retained and exaggerated, causing eyes to deviate with every movement of an unsteady head.

Initial sensory organization goals may be directed toward developing ability to fixate, to track moving stimuli, or to turn toward objects moving in from the peripheral visual field. Probes will explore differential responses to varying stimuli such as lights, patterned configurations, color, and faces.

Positioning may be a critical factor in developing these basic abilities. Our experience has suggested that supine positioning, with some flexion of head and legs to break up strong extension, head centered and fixed, is frequently the optimal condition for initial visual training. A head centering cushion has been helpful in facilitating the freeing and centering of the eyes necessary for these children to begin to achieve a fixation. A slight tilt up, however, may provide more contact with the environment. Our experience with an institutional population has been that many children's deformities prevent positioning in chairs or beanbags, and supine positioning on a long wedge, with high edge about one foot, and adequate head centering, may provide visual contact once some ability to fixate is achieved. In some instances side-lying will favor freeing eyes from lateral deviation (right side-lying for right deviation of gaze and head turn), while on the child's other side the deviation of gaze may be increased, preventing any fixation at all. It is important for teachers and therapists to investigate and measure basic visual abilities in different postures and design interventions accordingly.

Visual responses may also be affected by the disorders of state and arousal which may occur as a consequence of central nervous system problems--constant sleepiness, irritable crying and inability to soothe, or very labile fluctuations between states are examples. A child may be easily overloaded by sensory input, responding pleasurably one second, and crying the next. We have a great deal to learn about the effects of varying stimuli on disorders

of state and arousal with our handicapped population. For example, different types of vestibular stimulation can have varying effects. Bringing a child abruptly from supine to upright, or bouncing a little, has effected eye opening and alerting with several very lethargic children, similar to findings of Korner's research with neonates (Korner and Grobstein, 1966). Slow rhythmic rocking has enabled some very irritable and unsoothable infants to quiet and begin attending to outside stimuli. The visual organization of children with the complex deviations of gaze and poor fixations may be adversely affected by vestibular stimulation such as rocking or spinning, as they already have an exaggerated vestibulo-ocular reflex (Fieber, 1977). We feel it is important to carefully measure effects of any such stimulation on specific functional organization abilities such as fixation or on definable state changes (See Lewis (1972); Wolff (1966), and Moss and Robson (1970) for classification of states. Research with the differential effects of sensory stimuli on arousal level in infants may provide some implications for management of these problems (Birns et al, 1973; Brackbill, 1973).

Figures 1 and 2 illustrate the type of data we record in work with visual fixation or tracking. Baselines for visual fixation may determine: 1) latency time to obtain a fixation in a given stimulus trial such as 15 sec.; 2) duration of fixation; 3) responses to varied stimuli -- light or shiny, black and white checkered or bull's-eye patterns, colors, faces, and sound-visual versus visual alone. An objective can then be developed such as shortening latency time, and then increasing duration of fixation. With careful analysis of ongoing records, objectives and strategies can be revised. Changes in stimulous preference may demonstrate increasing discrimination.

Baselines for visual tracking may determine:1)arc, 2) eye movements alone (ocular pursuit) or more advanced eye-head movements (oculocephalic

pursuit); 3) direction; 4) stimulus effects. Information may show changes from movement of one eye only, to binocular coordination.

Long term goals may need to be expressed as open-ended for maximal use of any potential vision, because expected outcomes may be unknown when training begins. Initial short-term goals may need to be stated as exploratory probes. Any improvement in functional vision can be important for a multihandicapped child, and goals in this area need to be ongoing, parallel to other curriculum. The boy shown in the slides, for example, has become able to fixate and shift gaze after many months work, but cannot track at all due to specific central vision system problems. Work with sensorimotor cognitive development proceeded, however, adapting task presentations, and he now is using eye-pointing in beginning communication board work.

Further information on assessment and curriculum for the children with complex sensory organization problems is described in Fieber and Robinson (1974) and Fieber (1977).

Grasp scheme One of the most frustrating characteristics of some severely/profoundly handicapped children is lack of basic concepts of the hands as tools with objects. The basic scheme of grasping is included as the beginning of the Schemes for Relating to Objects subscale -- "Holds object 30 seconds." Grasp normally begins with automatic responses to stretch and touch, and during these automatic phases grasped objects are retained only very briefly. Voluntary grasp, or the "grasp scheme," normally appears as the reflex wanes, and the child retains grasp longer to maintain an interesting perception. Fisted hands begin to open and an open hand will encounter graspable things -- body parts, clothing, crib environment. Children with tightly fisted hands, abnormal postures, and restricted movement may not encounter graspables in

this way, and unless someone places things in their hands, may not develop a mental representation of grasp. Though they may have the idea and the intent, many severe athetoid children simply cannot maintain grasp due to conflicting withdrawal reactions. With other children there is no motor excuse -- hands are open, motor grasp occurs with grasping of hands or feet, but there is no grasp scheme for objects.

Early objectives for developing a grasp scheme for objects may be baselined and monitored by recording duration of grasp. If an object is placed in a tightly fisted hand, awareness or interest may be indicated by quieting, a tentative movement toward the mouth, visual or head orienting, etc. A strategy that has been useful with several children has involved tying a small bell or rattle in the child's palm with large colorful yarn for 5 minutes so that the object would not be immediately lost. During that 5 minutes we might record changes in the cumulative time fingers grasped and regrasped the object, or other awareness behaviors. Following the 5 minutes, the tie would be loosened, and 5 or 6 trials timed for duration of maintenance of grasp. At the beginning of tied and untied trials the teacher would squeeze the child's fingers around the object, guide to mouth or to gaze, shake a little, etc. As duration increased, commonly the tied trial could be eliminated.

The next steps would involve coordination of grasp with other schemes such as mouthing, looking, or listening, and at this point tying might again be needed for a time, as grasp might be difficult to maintain with arm movement. A fading of assistance might be appropriate here till grasp could be maintained with arm movement. Side-lying positioning would be explored to see if this facilitated this coordination. Maintaining grasp with arm movement is a motor ability; the intent to coordinate schemes, however, may be clear even though the child drops the object, and that intent reflects a cognitive scheme. Work

with the basic grasp scheme is planned in conjunction with other objectives under the subscale "Means for Achieving Environmental Events" and will be further discussed.

Sucking scheme Evaluation and training of sucking abilities or problems will not be discussed in this paper except brief mention of work with suck in early operant learning (Bijou and Baer, 1965; Kalnins and Bruner, 1973), and in the development of use of the hand as a tool. Control of environmental events such as visual or auditory spectacles by sucking has not been utilized with severely handicapped infants as far as I know, and may be impractical due to problems with this basic scheme. The role of sucking in the development of grasp begins with some automatic relationships such as the palmo-mental reflex. Coordination of voluntary grasping and mouthing schemes plays a prominent role in early hand use, but we do not know that this is essential for development of the hand as a tool with handicapped children. We have seen a number of children who have developed hand use and object exploitation without coordination of hand and mouth schemes, not always attributable to motor impairments, and several now feed themselves. We need to explore relationships with other behaviors such as chewing or acceptance of textured foods, praxic oral abilities related to speech sounds, etc. The mouth is such an important explorer for most sensory handicapped children that I am more comfortable with our other typical problem, the child who mouths too much!

Coordination of Basic Schemes

The initial items of the Sensorimotor Cognitive Assessment deal with coordination of basic schemes. Tracking 180° arcs involves coordinating head turn with eye following in order to maintain perceptual contact with an object (Visual Pursuit, Localization and Object Permanence subscale). The hand-watching behavior of the supine child involves moving arm in order to obtain or continue

perceptual contact with hand (Means for Achieving Environmental Events and Operational Causality subscales). Sound localizing in the Construction of Object Relationships in Space subscale involves coordination of head turn with auditory processing and results in visual and auditory correlation under normal circumstances. In the subscale for Schemes for Relating to Objects, in addition to coordination of grasp with mouthing, coordination of grasp with looking is a critical early behavior.

These coordinations of schemes may be very difficult for a motor impaired child. Strong tonic reflex posturing or severe oculomotor problems may interfere with tracking in wide arcs or turning eyes and head to sounds. Due to exaggerated neck extension and abnormal quality of the asymmetric tonic neck reflex, the handicapped child's hand may never intersect with his gaze, whereas in the normal child this pattern allows or facilitates hand-watching. Even in side-lying positioning, neck extension and upward eye deviation, combined with extended arms, may prevent hand watching.

Children with visual handicaps may demonstrate the hand-watching behavior but at such a close focal distance that this localization does not progress in the normal sequence to directing reach. The child who cannot focus on near objects, including hands, seems particularly diverted from normal hand use development. The blind child does not have this critical coordination at all.

Severely/profoundly handicapped children may demonstrate a variety of unique and personal behaviors which are at the level of this early coordination of schemes, and so do we all. These reflect a beginning level of "Means-end" or causality behaviors; however, in these children they maybe maladaptive and may not lead to further development. Examples are self-stimulatory behaviors such as the head-rolling of a visually impaired child, or hand flapping, eye pushing, etc. Such behaviors may fill a need for sensory input, especially

self-regulated input, and careful analysis can tell us a great deal about functioning abilities and reinforcing stimuli.

General Suggestions for Administering the Sensorimotor Cognitive Assessment

Each of the subscales of the Sensorimotor Cognitive Assessment will be described separately with examples of curriculum at the lower levels. If it appears that the child manipulates objects at all, the Schemes for Relating to Objects subscale is a good starting point. When a child is interested in an object, problems can be presented across the other subscales. Intrinsic motivation is a critical factor in performance. When a child does not perform a task it is suggested that the object be given again to the child to be sure he is still interested in it, and on occasion one may probe with an edible, such as a cookie.

To credit the child with a certain level of performance on any of the scales, three examples with different materials or situations should be successful. If the child has learned to perform the task only with specific materials, this may represent a "skill" but not the desired generalization which suggests a concept. Testing is continued in each of the subscales until two successive task levels are failed. When the child is failing a task, prompts or additional information can be given which will sustain interest and provide assistance in developing substeps.

It has been our experience that natural reinforcement of object and task interest are very important; thus, when the child searches for an object, the logical reinforcer is play with the object, and the examiner should not move too quickly to the next trial. Occasionally the examiner will need to use an edible reinforcer in addition to natural and social reinforcers, to enable some children to demonstrate their best abilities. Reinforcement should often be given for task effort, not an arbitrary task level, as there is no really

wrong response. Children will show unevenness and respond at one level with one object or condition, and at another level with a different object. The child with limited abilities can usually be assessed in one session; others may require two or three sessions.

I. Visual Pursuit, Localization, and the Permanence of Objects

This scale involves the development of the ability to represent objects and their location mentally -- being able to think about them when they are not in the child's immediate perception. Recognition that the object still exists is demonstrated by search for the object. This representational ability is considered to be prerequisite to development of symbolic thought and language.

A. Advanced Visual Pursuit and Localization. Prerequisite behaviors for object permanence.

1. Follows a slowly moving object through a complete arc of 180°.
2. Child maintains gaze at point where object he was tracking has disappeared.
3. Child reaches for and picks up (may or may not touch cover) an object which was partially covered as he observed.
4. Child follows an object suspended from a string through a complete arc around his head, and turns to side opposite its disappearance in anticipation of its re-emergence.
5. Child leans or moves in seat to look after an object which was dropped so that it falls out of the child's view. (The object should make very little sound.)

B. Object Permanence.

1. Single visible displacement with one screen. Object is covered completely. Child removes screen and takes object. Do not credit if child merely removes screen and plays with it.
2. Visible displacement, random alternation between two screens. The child removes correct screen and obtains object.
3. Sequential visible displacement with two screens. The visible object is moved slowly first under one screen and then placed

under the last screen.

4. Invisible displacement with one screen. Object is placed in examiner's hand, can, or box top, then released under the screen. Hand or box remain close. Child may check the last place he saw object first -- the hand, box, etc. -- but is credited if he continues search under the screen.
5. Invisible displacement with two screens. Searches directly under the correct screen.
6. Sequential invisible displacement with two screens. Child searches under screens, in order first to last, or directly under last.
7. Sequential invisible displacement with three screens. Child searches under screens, in order first to last, or directly last.
8. Representation of sequential invisible displacements. The object is hidden first in hand, can, or box, which is moved sequentially under the three screens, however, the object is released under the first screen. When the child does not find the object in searching under the last screen, he systematically checks back in reverse order. (This item is not administered unless child has progressed to search directly under last screen in No. 7.)

Adaptations for Motor Impairments

When the child is motor handicapped, he may respond with reach or point if possible, and the examiner can assist by lifting the cover. With those children who are unable to give a clear indication through pointing, an eye-point may be a more reliable response. This activity and strategy can be preparation for use of this indicator response with later language activities such as indicating named objects or pictures, or indicating wants presented as choices.

Children will search for objects before they understand or use referent pointing. A strategy useful with very severely motor handicapped children, when they do not yet use a systematic referent eye-point, is assisting the child's arm and hand motions, waiting for a beginning

movement that shows clear intent toward the covered object. In moving together, intent can be quite clear. Guiding should be done from behind to develop the best working relationship between the child and adult.

The child's ability to maintain eye-contact with the sequence of events is critical, and a child with an unsteady head or oculomotor control problems will have difficulties attending. He or she will be apt to make errors on the basis of lost eye contact or directional eye movement problems. The child's chair adaptations need to provide conditions which provide for head stability and centering without any tilt backward of head on the body. Some children's oculomotor control will be more efficient in a centered forward gaze, rather than down gaze, and raising the height of the task presentation will be helpful. This will also eliminate the dropping forward of the head that may occur with effort to look down at tray. Whenever the child's head drops forward in effort to look down at the tray, he not only may lose eye contact, but his eyes may roll up both as a counter-rotation upward with the head drop, and in an exaggerated roll up with head movement as the child lifts his head again. When such a child is ready to scan pictures, etc., a tilted up rack is needed.

Close cooperation of therapist and teacher are needed in design of adaptive chairs and other equipment. The external support conditions needed for attention and thinking will need to be more supporting than one might otherwise prescribe in a chair. For the sake of increasing motor control, one would like to allow the child some active control and challenge to right his own head if this is possible, and complete support all the time could inhibit motor progress. Obviously both conditions are important, and need to be provided for in the plan for the day.

Adaptations for Visual Impairment We will need different criterion behaviors for the blind child. Early mental representation and anticipation will occur in other sensory modalities - for example, the child's facial expression may indicate beginnings of memory when the music box or tickle game is paused. Some blind children will orient or turn to sounds later and seem to maintain that orientation briefly when the sound stops. Anticipatory responses may be seen with a kissing game alternately to each cheek, or in auditory-motor baby games.

When the sighted child first searches for visibly displaced objects, the object is associated with location. For the blind child, memory of expected location is particularly important. The child who has learned to repeat movements to activate a sound spectacle will begin to reach where the chimes have been suspended in the location he expects them to be. If he accidentally loses the object, he may begin some searching movements where he last had it, and we may see a beginning tactile sweep. If he encounters the object he may recognize and regrasp it. This type of behavior is seen between 27-36 weeks in otherwise normal blind infants according to Fraiberg (1966, 1975). This is when the sighted child is typically beginning search with a complete visible displacement. Rather than visual memory the child is using tactile - kinesthetic memory. Whether reach at this level is for specific object in mind, or where "something" should be, is debatable.

Not until 37-48 weeks does sound begin to evoke the concept of the object, and we may then see a blind child reach to a sounded object if he has just played with it. Not only is the sound recognizable, but it

evokes an idea of the object in terms of tactile - motor memory, derived from the child's experience acting on the object. At first this must be a familiar object. Fraiberg feels that reach to a sounded object which wasn't just played with by the child, will not be seen before 49 weeks. When this occurs the child will begin to move out into space to a sounded object--the beginning of orientation--mobility using sound.

Reach to sounded object also depends on the developmental level of sound localization, also considered in the spatial subscale. (Northern and Downs, 1974; Bower, 1977). The location of the sounded object is important. Inability to reach to sounded object may be because the direction is not yet possible, rather than due to lack of object concept. If the object is presented where the child typically expects something to be when he plays with an adult, one may assume he has a representation for the object, wheras he simply expects "something" to be there.

Commonly we will see a child reach near his ear in supine first, then on the floor, or on a tray laterally and downward in sitting. Because sound localization involves an interpretation of the difference in timing of sound waves reaching each ear, it is important that location be well lateralized. When a sound is presented in the middle, the child cannot tell if it is front or back, though he will learn by experience that it's usually in the front. Eventually he may learn to turn his head to assist localization.

Eventually a blind child will reach where he heard a sound which was discontinued, and with trust and experience, and older child reaches on very slight sound cues. I have seen a blind child remove obstacles over sounded objects, probably quite a high level of object permanence. Fraiberg feels

that the blind child does not complete development of object permanence until mobility around the house is established, and the child can search for mother or toy around the house - object existing independent of place.

The deaf-blind child with hearing in only one ear, or marked discrepancy between ears, has a real problem with sound localization. He is not going to be able to use environmental sounds in orientation; perhaps echo location using his own sounds is possible with change of head position.

I have seen a totally blind child with only one ear develop some localizing abilities within his own space, after we worked on pairing sound with touch to body. I don't know how he was doing this. In such instances, inability to reach to sounded object may not mean lack of object permanence concepts. The sound may be recognizable and evoke imagery for the object. We might see persistent search with increasingly systematic tactile scanning suggesting object concept.

The partially sighted child often fools us into overestimating his visual learning ability. He may be able to track, maintain gaze at point of disappearance, and even search for a visibly displaced object with one or two screens - at which levels the object is closely associated with location. Then the child seems to be stuck and not progressing to the more complex search problems. Perhaps the child does not have the higher level visual imagery - possibly due to inadequate discrimination of the object, possibly due to some inability to form visual imagery. In any case, we may need to help the child acquire mental representation for the object, as the blind child does.

II. Means for Obtaining Desired Environmental Events (Means-ends)

In this subscale we look at the child's use of one behavior pattern or scheme as a means to effect another end or goal. We see the child beginning to attempt to maintain or regain interesting environmental events, development of the hand as a tool in the early stages, and objects as tools in the later stages. Increasing intentionality or foresight are the essence of this subscale, and increasing differentiation of means and ends. This subscale, with the Causality subscale, we believe, are closely related to the early development of communication, as the child learns to use signals to indicate wants and to foresee their effect. The upper stages of this scale have been found to correlate highly with the emergence of one-word phrases (Snyder, 1976).

1. Hand-watching. Coordination of two schemes, moving arms to visually explore hand. Generally observed in supine position in infants.

2. Child repeats an early motor movement (batting, kicking, head motion, etc.) which activates a visual or auditory spectacle.

3. Child reaches and grasps toy when both hand and toy are in view.

4. Child reaches and grasps toy with just toy in view.

5. Child pulls a support (pillow, cloth, boxtop, etc.) to obtain toy which is just out of reach. (With or without demonstration. Record demonstration as prompt.)

6. Child uses some form of locomotion or movement between postures to obtain a toy out of reach.

7. When a toy is held above a support, the child does not pull the support as previously, but realizes he must reach or signal for the object. (This item is not administered unless the child passes No. 5 above.)

8. Child pulls string to obtain object on a horizontal surface. (With or without demonstration.)

9. Child uses string tied to object to obtain it while it is not in the direct line of sight, pulling string vertically usually. (With or

without demonstration.)

10. Child uses an object within reach (stick, small rake, large spoon, etc) to obtain object which is out of reach.

11. In the problem of putting a long necklace or string of beads into a tippy container, such as paper cup or tall narrow container, the child foresees likely fall of the container, and adapts a successful approach from the start. Foresightful behavior might be bunching beads in hand, stabilizing cup with other hand, lowering beads carefully by string, etc.

12. Child does not attempt to stack a solid ring which is mixed in with other rings for post. This implies mental representation of the end and the means, and foresight, rather than the hindsight after an unsuccessful attempt to put it on the post.

Development of reach as a means to grasp

Problems in the development of simple reach and grasp will involve cognitive factors, motor factors, and sensory factors, especially vision and hearing. The early hand-watching behavior and the grasp scheme are both important precursors. The very early sequence of events, leading finally to reach as a means to grasp, has been described by White and coworkers (White, Castle, and Held, 1964; White, Held, and Castle, 1967; White, 1969) and by Bruner (1969).

The beginnings of reach and grasp seem to be separate mental events, which are finally coordinated, a kind of sequencing forward. Experience with assessing and training a number of children who did not use their hands, suggests that discrepancies may exist between the two schemes. It is appropriate to design parallel curriculum sequences which finally merge, rather than arbitrarily sequencing grasp and reach events together.

In the normal course of events, the child's interest in visual stimuli, increasing accommodative ability for different focal distances, hand-watching, and seeing hand by stimulus, may lead to an approach movement to the visual stimulus, perhaps without any intent to act on the object.

This type of experience, and the discovery that arm and leg movements may cause something hanging in the crib to move or sound, may vary in sequence according to the child's visual abilities and environmental circumstances. See work of Watson and Ramey (1972; Watson, 1977) for research with

normal infants.

Repeated encounters may lead to a mental association between hand and object, and the anticipation that develops evolves toward the reach that can be used for batting or later for grasping. In motor development we often see a similar sequence--experience in a new posture prepares, with new righting abilities, for independently assuming the posture. In the development of hand use, seeing or hearing or touching one's hand with a stimulus prepares for intentionally placing hand by the stimulus. Spatial location of arm placement also synchronizes with visual or auditory location.

Use of limb movements which produce an interesting auditory or visual event begins with an accidental encounter. With repeated accidental encounters, the child begins to realize that his movements will maintain this interesting event. He may test this great discovery by pausing and looking, then show a flurry of action again, as if to confirm his discovery. Eventually the child will show intention or foresight to initiate the movement when the object is seen, or sounded, or perhaps touched to his hand and withdrawn a little. We will record which cue seems to elicit the intentional movement. Often we see progress from touch to sound or "ear-hand," and finally to visual cue, if functional vision improves with our visually impaired children.

Any body movement may be utilized that is already in the child's repertoire, however, it is arm movement, evolving from a fisted batting or swiping to open-handed batting, that leads to reach and grasp. It is not unusual to see hands that have been fisted in flexor spasm begin to open, though extension in protective extension or propping are not yet present. In the course of discovery of himself as an actor on environment, and a causer of interesting events, one will see intention generalized to other dangling "batters." A progression from use of all limbs, both arms, etc, to use of the limb

producing the event also will occur, though slowly with the cerebral palsied child. (Figure 3).

With the initial objective, "Child systematically repeats movement which produces an auditory/visual event," the first step is to observe the child's spontaneous movements to determine the most probable movement, and to define it in terms of part of limb, direction, and arc so that it can be counted. The second step is to record a baseline of 3 or 5 minutes of number of movements. The third step is to place an easily activated auditory/visual spectacle maker, such as brass or "fish-scale" wind-chimes, in contact with the limb so that the slightest movement activates it. We avoid tinkling the chimes when the child is not moving, but guarantee a tinkle even for minimal movements. A yarn tie with slight tension may help harness slight movements, and may increase awareness of the limb. We often need to experiment with placement of the chimes till we get an optimal condition. We again record the number of movements in 3 or 5 minutes, not just the successful ones in tinkling the chimes, as we want a consistency with our baseline method. In early training it may be helpful to record baselines and contingent movements for each session, as changes are slow for some children. Performance may be variable from day to day due to seizures, arousal problems, etc. A less frequent sample may not catch the child on his good days.

One may need to experiment with different positioning arrangements. Experience has suggested that the child who does not use his hands will often move limbs more easily, and deal with the visual and auditory spatial locations more successfully, in the supine posture. This is where normal infants develop the basic concepts and motor patterns for hand use. Some control of abnormal extensor tone, which is often exaggerated in supine, is helpful--

a pillow to flex head, and perhaps flexion of legs over a support or one's lap. The child's head should be allowed to turn a little toward the event, and arms left in the horizontal plane to start--also where they are in the normal infant at this point. Stimulus presentation should be clearly lateral; batting toward the midline will come later, if possible. Sidelying may be utilized also, and counting and recording number of movements will determine usefulness. At this time these positioning interventions are suggested only for those children who are not using their hands, and are based on successful experience with this group. I am not prepared to generalize these suggestions to the cerebral palsied child who obviously tries to use his hands without more investigation as other principles may be appropriate in their management.

As a therapist I used to feel concern about the child's "use of abnormal patterns" and was concerned that an increase of tonic reflex activity might result from these activities in supine. Experience has caused me to revise these premises and to be more concerned about the effects of never acting on environment, both on the child's cognitive development and motor development. As one sees the child develop intentionality, the child may break through his abnormal postural patterns. With the development of reach and grasp, one can then work toward the more symmetrical movements. The child, of course, should not be left too long in an asymmetric supine posture, or any posture, as that can contribute to deformities. We should be concerned with providing a variety of postures, considering the advantages and disadvantages for each. "Good positioning" may also be deformity producing, and interfere with early sensory organization and cognitive development if the child cannot organize attention, sensory functions, and act effectively in that position.

As we see a systematic increase of movement, and the development of more intention, goals can be set toward shaping movement more toward a swat to the side. It is a good rule to practice with each arm, just as with grasp, and to stay with one arm and hand during a session at first. It is not unusual to have one hand be best at grasp, the opposite arm best at directed reach and batting, often related to the child's tonic neck reflex pattern. In time the child will get these together, more typically with the best batting hand.

Once one has determined a workable combination, environmental arrangements can be utilized for those periods when direct attention is not provided. It is important not to leave such an arrangement too long, however, as the child may become satiated and be unable to get away from the stimulus. It is also important to work for generalization and accommodation across other dangling objects, or with "tippy tinkle toys" such as a "Happy Apple," before considering this level proficient.

Hopefully the child has also been establishing a "grasp scheme" and has progressed to coordination of the grasp with mouthing, looking, or listening. Strategies for developing these further coordinations cannot be described in detail in this paper. A significant step then occurs in which the child sees or hears the object and bats at it intentionally. When contacting it, he may seem to think of grasping, as if an afterthought. With our severely/profoundly handicapped children who are developing mental representation so slowly, this appears to be a major stage occurring before the child reaches with his hand shaped in readiness with intent to grasp. With these children I have not really seen the slow approach with alternate glancing between hand and object, which has been described in normal infants as Piagetian reach. With time the child will need to retrace some of these steps in sitting with objects on tray, and in other positions.

Obviously the steps for a visually impaired child will be different, and will depend more on sound localization. Included are the children whose hand-gazing is very close, and the hyperopic (farsighted) children who have no visual contact with hands or near objects. The development of direct reach to sound cue is delayed several months in the blind infant, depending on development of sound localizing in several directional gradients, as well as beginning concepts of object permanence. These sequences have been described in detail by Fraiberg (1966) (See Table 1). The work on grasp scheme, coordination of grasp scheme with mouthing or listening schemes, and systematic repetition of movements causing an auditory spectacle will prepare for eventual reach to sound.

Objects out of reach In our experience the order of the items for strategies for obtaining objects out of reach---pulling a support, horizontal string, or locomotion---is somewhat variable depending on the motor abilities and experiences of the child. When great motor effort is involved in moving to object out of reach, well-established intentionality or ability to hold a thought through intervening events is needed. I have just seen a child whose cognitive development is delayed even more than his motor development. He is just becoming able to turn from sitting to all-fours to creep. He seemed to demonstrate intent to obtain an object out of reach, but by the time he had completed his rotation maneuver, he had forgotten his goal. He had also momentarily lost sight of it in turning, and perhaps it no longer existed for him. One strategy might be to sound the object to attempt to hold his attention and intention. One might also design a shaping procedure, gradually requiring more of the motor sequence before giving the toy to the child. When the child's intention is strong, it is an advantage in gross motor training, and should not be squelched by failure to provide for appropriate reinforcement.

Some children will need to learn that each new ability to change posture or

locomote can be a means to obtain things out of reach. One will need to observe carefully and try to decide if a child is moving for the fun of it and happening upon toys, or localizing and moving intentionally to toys. For the blind child this will again be a sound localization problem, and movement into space may come slowly. (Fraiberg, 1966; Fieber, 1974). The child may learn to pull a supporting object through accidental or guided pulling, then realize this is means for obtaining a wanted object. Similarly, experience with a string on an object will be necessary before the child will use a string as a means. Use of separate tool can be learned through guided movement. All of these will depend on some degree of object permanence for the blind child, and will not occur till a later stage in the blind child.

III. Development of Operational Causality

A child begins to understand causal principles when he begins to anticipate events. Through repeated sequential events he begins to think ahead. Causality behaviors are merged with "means-ends" behaviors in the early stages of acting to produce interesting sights or sounds. Then the child begins to generalize his repetitive actions to other circumstances where he really isn't the causal agent. He feels at first that he is the source or cause of events, but later begins to realize causality exists outside himself and attempts to act on the source of the interesting event. He increasingly communicates with adults who can make things work for him, and finally learns through imitation to identify and activate the agent which makes mechanical toys work.

1. Hand-watching behavior. Momentary control over a source of input is made possible by coordination of two schemes.
2. Child repeats motor movement (batting, kicking, head motion, etc.) which activates a visual or auditory spectacle.
3. Examiner performs a spectacle such as swinging a toy, winding up music box, etc. and when it is paused the child uses a "procedure" to elicit the event again. This may be a batting motion , kicking, or vocalization, something he has previously used to activate things himself.
4. Child touches the object or examiner's hand when the examiner has demon-

strated an activity with an interesting wind-up toy and then stopped it. The examiner's hand should be available in reach.

5. Child makes a mechanical toy perform its action manually. Examples are pushing the wind-up car, directly moving the arms and legs of the clown activated by pulling a ring, or turning the wheel of the wind-up musical ferris wheel.
6. Child hands toy back to examiner to activate it again. At this level the child is more clearly requesting the action. Some children may guide the examiner's hand to the toy.
7. Child attemts to activate mechanical toy himself after demonstration.
8. Child attempts to activate the mechanical toy himself directly. Note: Success at final level implies completion of lower levels. Present a variety of mechanical toys, activating them first without the child seeing you wind, then with demonstration.

Procedures--Beginnings of Communication When an interesting spectacle or event caused by the examiner is stopped, the child must be able to represent this event mentally at least briefly, and to anticipate that his procedure may reinstitute it. When the child has not been demonstrating the signs of beginning mental representation and anticipation in the visual channel, other sensory modes should be explored. For example, one little girl I work with has visual tracking and directed reach, but does not show mental representation of visual events such as maintaining gaze at point of disappearance. She does not signal for more of a visual event. She seems to remember an auditory event such as a wind-up music box, as indicated by a continuing expression of attending and smiling. She will hit at the music box when it stops, a "procedure" generalized from her scheme for hitting at chimes and "tippy tinkle toys." She also enjoys being swung in a blanket, and when this is stopped, shows similar attending and expectation, then either hits or kicks. She also enjoys a little game we have of tickling and making funny lip sounds that she makes, and when we pause, will use this sound as a "procedure" for more of the game. Because our children have been reinforced for vocalizing, they will often use vocalizations as "procedures." It is important not to be arbitrary at this point about either the eliciting situations, or the

"procedure" the child chooses. At this level he may use different ones for different situations. Observation for any little action on the part of the child can be shaped toward a more systematic signal if one sees the signs of the child continuing to think about the event when it is paused.

Fussing is sometimes used as a "procedure" by handicapped children, perhaps because they have not had other successful experiences making things happen. Fussing has resulted in mother's attention, or the winding-up of the mechanical swing or the mobile. For such a child one will need to work at helping the child to develop other ways of acting on the environment.

Mechanical toys A child with a severe motor handicap can learn to signal to others, and to indicate understanding that a winder or lever is the causative agent for a toy by touching it or looking pointedly at it. It is desirable, however, for the child to have some success directly activating things himself, or with minimal assistance. Toys which some motor handicapped children may be able to activate are: keyboard toys such as "Whistling Songbirds," "Bigmouth Singers," and "Melody Mike" the "Pound-aRound" the "Surprise Box," "Tomy Choo-choo," and pull-ring talking toys with a larger ring attached.
Toys which a visually impaired or deaf/blind child may think are perceptually interesting, might be a Lite-Brite or flashlight, vibrator, etc. Guided motion will be necessary in demonstration to the visually impaired child.

IV. Construction of Object Relations in Space

This subscale includes several categories of spatial concepts. We see the child beginning to recognize that objects differ in position in space, and beginning to relate to them. He begins to understand the spatial orientation of an object for function. He can reconstruct trajectories of rapidly moving objects and infer their spatial location, and begin to understand space coordinates related to his body surface. He experiments with the effects of gravity, and expands his construction of space outside his immediate reach as he moves out into space and deals with obstacles. Because of the different categories of spatial concepts involved, the insertion of items for which the sequence is unclear, and the variable experiences of multihandicapped children, we find more inconsistencies in sequence. It is necessary to check the different aspects of spatial relations rather than stopping testing after two failures.

1. Alternate glancing rapidly between two visual targets. (Substep is slow alternate glancing.)
2. Child turns eyes and head and focuses on a sound source presented laterally and outside his visual field.
3. Grasps object directly when within reach.
4. Reconstructs trajectory of falling object and directs eyes to place where it must have come to rest.
5. Searches for a dropped object when the end of the trajectory is out of view.
6. Searches in direction of trajectory of object slowly moved behind him.
7. Child indicates recognition of reversal or different sides of an object by turning it to its "right" side.
8. Searches behind him for object moved rapidly behind him.
9. Child brings two functionally related objects together producing physical contact at least three times. (Xylophone and stick, spoon and cup, drum and stick, etc.)
10. Child uses one object as a container for another. Several levels of container concepts may be demonstrated when the examiner places several objects in container; removes them both singly and "en masse" by dumping. Examiner notes whether child seriates several objects in and out one by one, or whether child imitatively reverses and dumps container.
11. Child builds tower of two or three blocks.
12. Child places toy on inclined plane and permits it to roll down the incline following demonstration.

13. Child moves entire body around a barrier and retrieves a visible object. The object should be moved so that the shortest distance to retrieving it is on the opposite side of the direction it moved.
14. Child moves around barrier to obtain object moved from visual field.
15. Child places one nested cup inside another (series of 4 round cups) without demonstration.

The final item of the Uzgiris-Hunt scale was not included in the current subscale in use in our program because of the frequent lack of mobility of our population. "Child indicates knowledge of usual whereabouts of familiar persons and recognizes their current absence. Representation of familiar space is implied by memory of usual locations of objects or persons in it." The child can be moved and helped to learn about familiar spaces at home and school, and assisted to search for and find things. Understanding can be indicated by eye or hand pointing and gestures where possible. The blind child, if given the opportunity, will develop an internal space map of his familiar environment. The teacher can begin guidance of tracking of room peripheries and landmarks as soon as the child has some locomotion.

These spatial items are often found in developmental checklists used by educational programs under the category of fine motor abilities. Here we are probing the child's understanding, not his fine motor abilities, and will assist him motorically as necessary. For example, in the block stacking item, the child may indicate understanding of vertical spatial relationships by trying to place one on another, but be unable to control release. He may show beginning seriation as he sequences more without prompting. Although fine motor objectives such as accurate controlled release might also be included in a child's goals, his concepts do not need to wait for progress in motor proficiency that may never come. In assisting the child to participate one satisfies his urge "to do, " and it is not difficult to tell the intent of the child's movements. Some interpreters of Piaget feel that sensorimotor cognition develops only through doing. We would modify this to learning through experience, not necessarily only motor experience.

Alternate Glancing The ability to shift gaze between objects develops from two months on in the normal infant, beginning with horizontal shifts, and by four months also between far and near, as vergent eye movements and accommodation mature. These abilities involve both development of higher central visual system functions and ability to regulate or shift one's attention. Some children we see seem to remain at earlier levels of attention or diffuse distractibility, or at the next stage where the child is caught by stimuli and often seems to be "stuck" in his attention. See Bruner (1969) for a discussion of the sequential organization of perceptual attention.

Work with shifting attention might initially involve presenting two interesting visual stimuli and using sound or movement cues initially to assist shift of gaze. In play with the child, one can present two toys on the table, and encourage the child to look at both, then to play with them alternately. When the child begins to hold two objects we may see further awareness of 'two' as he alternately looks, shakes, or begins to combine them.

Sound Localization The first localizing eye-turns to sound out of sight occur laterally at a close distance shortly by about two months, and coordinated eyes-with-head turns by four months. Sound localization appears to develop in a predictable directional gradient. (Northern and Downs, 1974). Not until nine or ten months does the child look directly to a lateral and downward sound source, and localization of sound out of reach is only beginning at that point. With the sensory and oculomotor problems typical of many of our multihandicapped children, they may never identify what is making a sound. This directional development is probably one factor related to the development of directed reach in the blind child, or "ear-hand coordination." Many blind children do not turn to sounds, but keep their faces frontally oriented, or orient only slightly to the side. In our experience the turning response occurs under conditions such as sound stopping, or when the child begins to reach to the sound. We should not expect the same response

when it does not result in visual identification of the sound source.

In assessing and working with sound localization, we first position the child with his head centered to reduce any tonic deviations of gaze, and start with the eyes in mid-position. It is necessary that movement of the object or one's arm doesn't stimulate peripheral vision. The examiner can extend both arms as he faces the child, to avoid cueing the child if help is not available. We present a variety of sounds of varying frequencies and loudness, including voices, and keep track of what was used. Often combined frequencies, especially voice, are more interesting than purer tones. Positioning in some flexion may reduce some startles, but noisemakers are avoided which seem to elicit startles. We record if the child seems to respond, or not respond, selectively to certain noisemakers, or any tendency to asymmetry. At first one may want to record the latency, or how long it takes to elicit a response, within a 15 or 20 seconds trial, and note improved speed of processing. We also note whether an eye turn or eye-head turn was obtained. Some of the multihandicapped children we see have possible central auditory system problems, and poor responses do not necessarily mean receptive hearing problems. Organization may improve, however, an audiological evaluation is indicated if responses do not change.

Teaching to the point of success is suggested when the child does not respond, teasing the stimulus in and out of the peripheral vision, guiding a head turn, or touching the side of head to cue him. Touch cues to body parts can help the severely visually impaired child localize in other directions. The natural reinforcer for localization is seeing, or being helped to manipulate the source. If the child cannot fix at the periphery, we move the object to a centered position. As we work with sound localization we should keep in mind

the function - making visual meaning of sound sources as well as guiding orientation. When a child does not follow through with a visual fixation and identification, one can assume the child is going to have problems in making meaning of sound. Correlating information will need to be provided through other sensory modes.

Development of Imitation

V. Vocal Imitation

The beginnings of vocal imitation are heard in a child's spontaneous vocal play, and as the child hears these sounds and speech around him repeatedly, they become recognizable. The first imitation of sounds must be based on sounds in the child's vocal play repertoire. Vocal imitative responses are best assessed during play or administration of other activities, taking advantage of communication and sharing with the child, and spontaneous vocal play.

1. Spontaneous vocalizations occur other than distress sounds, implying some differentiation of the vocalizing scheme.
2. Child shows recognition of "own" sounds made by examiner, by surprised facial expression, smile, etc.
3. Child repeats "own" sounds initiated by examiner (coo, ah, gah, etc.)
4. When examiner initiates child's familiar babbling sounds (baba, mama, dada, nana, etc.) the child responds with vocalizations, but not same sound.
5. Child repeats familiar babbling sounds initiated by examiner.
6. When examiner vocalizes novel sounds, not in child's repertoire, child vocalizes similar sounds by gradual approximations.
7. Child repeats novel sounds directly.
8. Child repeats simple new words.

In our population we have seen a step between items 2 & 3 above. This involves the child initiating the sound in vocal play, examiner imitating child's sounds, and child showing awareness and reciprocally repeating the sound. Many of our youngsters will repeat at this lower level before imitating an adult initiated sound.

Because articulation problems due to dysarthria or apraxia may prevent a child from making certain sounds, evaluation by a speech pathologist is indicated if the child's sensorimotor level is nearing symbolic readiness but sounds are very limited. Alternative methods of communication may need to be considered. It is important not to emphasize vocal imitation at the expense of developing language meaning and reception through appropriate language input in meaningful activities. Language input may need to be in another mode, such as natural gesture, manual sign, or "touch communication" as utilized by teachers of deaf-blind children (Collins, 1973). With lower functioning children, pre-linguistic forms of signals and referent behaviors which develop during the sensorimotor period should be established as working communication (Robbins, 1967; 1973).

VI. Motor (Gestural) Imitation

Motor imitation development follows a similar sequence, progressing from familiar movements to unfamiliar. This scale is particularly relevant if manual communication is being considered, and will effect the learning of many other skills. This scale is often considerably delayed compared to other scales with our deaf-blind and other low functioning children, and may imply some special problems with visualization or imagery processing.

1. Child demonstrates recognition of a familiar movement performed by examiner, and may make some movement in response, but does not imitate the scheme
2. Child imitates the familiar movement demonstrated by examiner.
3. -5. Child imitates a familiar scheme in a new way or with new objects, i.e. hitting two blocks together, hitting keyboard toy instead of familiar Happy Apple.
   Level 3. Unsuccessful attempt at imitation.
   Level 4. Imitates the action by gradual approximation.
   Level 5. Imitates the action directly.
6. - 7. When the examiner demonstrates unfamiliar motor schemes or gestures to the child (verify unfamiliarity by asking parent) e.g., raising arms up high, scratching surface, "roll it" in pattycake, etc. These should be motions child can see himself perform.
   Level 6. Child imitates several gestures by gradual approximation.
   Level 7. Child imitates several gestures directly.

8.- 9. Demonstrate unfamiliar motor schemes which the child cannot see himself perform e.g., opening and closing eyes, tongue movements to corners of mouth, wrinkle brow, etc.
Level 8. Imitates gesture by gradual approximation.
Level 9. Imitates gesture directly.

Before the child imitates familiar movements demonstrated by the examiner, he may repeat when he has initiated the movement and the examiner imitates child. Common familiar movements are hitting or knocking on table or tray surface, banging, shaking, etc. The early levels of motor imitation are more easily elicited around such familiar object schemes, which can be determined by administering the Object Scheme Assessment. It is not unusual to obtain responses at one level with one scheme, and at another level with another scheme.

When a child does not imitate demonstrated movements, we may check to see if he will repeat a guided movement. This is appropriate also for visually impaired children. In guiding hand and arm movement, the adult should be sitting behind or beside the child so that his arms point the same way as the child's. This decreases the likelihood of defensiveness and enables the child to establish correspondence between his movements and the adult's movements. We begin with sharing of something the child is enjoying doing, for example, child hits tray, teacher hits tray and then guides child in hitting briefly, verbalizing "hit, hit." One begins this gradually, and cannot do this without trust and good communication with the child.

Sometimes a child will first repeat a guided movement, then come to recognize and imitate it visually. Some partially sighted children may be deficient in visual discrimination, or imagery processing and only imitate well rehearsed movements. They may need to follow the guided movement route. The "co-active movements" derived from Van Dijk's work and utilized by teachers of deaf/blind

children, follow a similar sequence (Van Dijk, 1965; Fieber, 1975). Because so many of these children have been deficient in object schemes, gross motor postures and locomotor patterns within a child's capabilities have often been used in "co-active movement" sequences. It is important that the teacher realize that moving together co-actively is not some magical exercise routine, but an approach to be used in many shared experiences and activities of daily living.

Some of the profoundly retarded children who occupy themselves with self-stimulation, such as intricate finger movements, have shown interesting responses when the examiner imitated their movements. Affective responses such as laughing or anger, and beginning eye contact have occurred. A strategy utilized by the Robbins (1968) is to share an activity such as rocking with the child to music, emphasizing "stop and go" with the music. Forward-backward rocking might then be modified to accommodate to a new situation such as teacher and child sitting astride a large roll and rocking side-to-side. Imitation work is very much a social communication and strengthened by a relationship with the child and sharing of pleasurable experiences. When one touches base with the child's reality and shares it, the imitation play leads to beginnings of communication. Imitative play together is often the situation where one elicits spontaneous eye contacts and interpersonal smiles, even in children who have been considered autistic.

VII. Development of Schemes for Relating to Objects

The child's spontaneous play with objects reveals the development of meaning of objects. The cognitive structures or meaning, as shown by the child's actions with objects, are called schemes. An object scheme assessment is included in the Sensorimotor Assessment (Figure 4). The schemes are divided into three classes -- simple, complex, and social and are roughly ordinal in sequence (Uzgiris, 1967). The following sequence of criterion behaviors has been described by Uzgiris and Hunt (1975).

1. Incidental use of object in the exercise of a scheme (mouthing).
2. Momentary attention to the object involved in the exercise of a scheme (visual inspection).
3. Systematic use of objects in the exercise of schemes (hitting schemes).
4. Beginning differentiation of schemes as a result of interaction with different objects (shaking).
5. Shift of attention from the exercise of schemes to investigation of properties of objects (examining).
6. Selective application of schemes dependent on the properties of objects (differentiated complex schemes).
7. Acquisition of new schemes as a result of studying various properties of objects (dropping and throwing).
8. Representation of functional use of objects (beginning appreciation of social use, holds cup as if to drink, etc.).
9. Reference to objects in shared interaction (pointing, showing, sharing).
10. Verbal expression of recognition (naming or related word).

In assessing schemes, the child is given a collection of objects such as those listed across the top of the scheme assessment form. Spontaneous behaviors with an object are recorded for an arbitrary amount of time such as two minutes. Each scheme demonstrated with the object is checked, and it is interesting to note the first and second schemes tried. The child is considered to have a certain scheme if it is observed with at least two different objects. Analysis according to the scale of criterion behaviors is then done.

The child who is mainly in the stage of simple object schemes does the same things with all objects, incorporating them into his actions. Meaning is in visual, auditory, or oral tactile sensations, so the child's sensory handicap will affect which are meaningful to him. With the opportunity to experience these simple schemes with many interesting objects, the schemes become internalized. The child tries out sequences such as shake-transfer-shake. He discovers an object is a poor shaker but an interesting banger, and indicates growing recognition for the toy and its properties by going directly to hitting on surface. This may be either a visual, oral, or manual recognition.

As the child learns that his repertoire of schemes if reinforcing according to variable properties of objects, he develops schemes of the complex class. The turning point is characterized by visual and manual examining behaviors, and sometimes examining at the mouth. The child turns, pokes, and feels and becomes more interested in properties of the object. He discovers and tries out many new schemes which are based on the properties of the objects such as crumpling or stretching. He reaches that dreadful throwing stage, and systematically drops and picks up, and drops again. Till the child shows this complex class of schemes he is not ready for container concepts or stacking. These behaviors can be taught operantly, of course, but may have no meaning for the child unless based on the necessary readiness.

The social schemes involve beginning representational behaviors. The child demonstrates functional use which has been socially learned, such as taking the cup to mouth as if thinking, "It's an object to drink with." The child's first functional use representations are self-directed. Then they become more social and communicative as the child gives the teacher, mom, or a doll a "drink." Pointing and showing, giving and sharing behaviors increase, and the child may name the object or what it signifies, such as "milk" for cup. The child now has imagery and deferred imitation, and is showing readiness for more formal symbol training in whatever language mode is appropriate (Bricker and Bricker, 1974; Robbins and Stenquist, 1972).

Children will show considerable overlap between stages or classes of schemes. The child who enjoys crumpling and tearing paper may still hit, shake, or mouth it. He may show functional use of the cup, then throw it.

With the very low functioning child I personally feel work in expanding object schemes is one of the most important areas of curriculum. One then begins to see a child play with objects, reduce self-stimulation, and to experience some of the events which lead to incidental learning in normal children. Activities are designed with objects based on the child's current schemes. The child's sensory abilities and interests are considered. For example, a number of children have been interested primarily in the visual or tactile characteristic of movement, and quickly discard other objects. I prefer to interpret this as what the child is able to perceive, and not to assume that the child sees and perceives the object the same way I do. For that child, I try everything that has a trick movement such as my slinky collection of different colors. Another child may be interested only in shiny, light catching objects and we will start with these.

Many interesting objects are introduced to the child's existing schemes and apparent perceptual interest, and as the scheme becomes stronger, we gradually require more accommodation. For example, if the child hits the chime, one might offer a "Happy Apple," chime-ball, or balloon with bells. We might then try to accommodate the scheme further to the "Roly-Poly Chimes," or a keyboard toy such as the "Whistling Songbirds." If the child likes flashlights or mirrors we will introduce a variety of these - keeping in mind that perhaps that's what the child perceives visually.

The "same but different" novelty principle will provide general guidance. If the new action is too discrepant with the old, the child will not be able to accommodate his scheme and will lose interest. This principle also helps in sustaining attention. After the child has just played with a piece of crinkly florist paper, a piece of tissue paper kleenex, or foil is the "same but different," and the child will begin to explore.

The visually impaired child may have great difficulty reaching the stage of functional use representation because of limited perceptions in his experiences with the objects encountered in his daily care. If visual discrimination or imagery for an object such as a cup is inadequate, the child will exploit it by banging, shaking, rolling, dropping, but not relate it to the experience of drinking. He must have been guided to hold the cup in the act of drinking, if he is to show such behavior. His imagery will need to be in the tactile - motor channels. Similarly, if he has been only on the receiving end of a washcloth, it will only be something to shake unless he has been guided to use it in washing. This is why, in deaf/blind education, we stress guiding or "putting the child through" the events of daily living, to provide a more complete perception of the event and a basis for motor imagery. This can be done in combination with fading techniques, as feasible, when we feel the child can begin to acquire self-help skills in the area.

In working with a number of children developing beginning object schemes, I am revising my concepts of the role of textures in very early object scheme development, and increasingly impressed with the role visual and auditory properties play even with our deaf-blind children, who usually have residual in at least one modality. We do sometimes see early fingering, especially of self or mother as described by Fraiberg in her studies of blind infants (1971). Sometimes we see manual object identification and selection of a favorite toy. Often as the child moves into the complex class of schemes, and realizes objects are good for different things, more acceptance or interest in texture emerges spontaneously. We really need research on the role of very early manual tactile functions, and what kind of tactile input is needed at different stages. Meanwhile, I am proceeding more cautiously with my collection of "feelies," especially with avoidant children, and emphasizing the meaning of the object or the feeling.

We may guide the child to feel his own body, or to feel mother's face, or teacher's face, and associate this with identification. We will be sure a "feelie" is classifiable in terms of actions the child likes to do with the object. As with any kind of sensory stimulation or bombardment, one is wise to let the child's reaction be the guide as to his ability to process the input. We need to think more of how the child can regulate inputs than of stimulation.

Concluding suggestions

Cognitive curriculum is effective when it is applied across activities of a school day or daily life, as well as in structured session teaching. Creative teachers will find many opportunities in activities such as music, art, playground, or snack times, to carry out the individualized goals for children. We feel that when a teacher or parent can do this, learning becomes more interesting and generalization more certain. Although probes and measurements are more easily carried out during session teaching, recording can occur also throughout the day. Most activities are best recorded in terms of numbers of opportunity trials, rather than frequency per minute data. See Fig. 5 for sample written objectives and probes.

Appropriate language and pre-linguistic communication must be used and encouraged in all activities. If there is a discrepancy between sensorimotor cognitive and communication levels, careful thought should be given to level and mode of communication. In teaching the parents the parallel and self-talk verbal style we try to teach them to relate this with gesture to what the child is interested in, or thinking about at the moment. Frequently this is reinforcing in itself, and helps lead to the "mental set" that "things are represented by words, signs, touch cues, etc."

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TABLE I

SEQUENCE OF DEVELOPMENT OF DIRECTED REACH IN BLIND INFANT

ACCORDING TO FRAIBERG

23-28 wks. Hand pantomimes action briefly when grasped object is withdrawn.
Object sounded, without previous manipulation, no response.
Object touched to fingers, hand explores and grasps.
Object sounded, after previous manipulation, no response.
Does not yet search tactilely where lost object.

At this stage sound doesn't confer substantiality to object, though infant discriminates mother's voice. Hearing and holding are separate events.

27-36 wks. Object touched to hand, beginning search.
Beginning random search in place expects object to be.
Accidental contact results in grasp, then shakes, etc.
Object sounded, after previous manipulation, hand seems to activate in grasp movement, but no search, however head seems to orient to sound occasionally.
Repeats guided familiar banging object, kinesthetic memory.
Patty-cakes on verbal cue.
Stereognosis--recognizes cup manually and takes to mouth.

Interprets as sound not eliciting tactile-motor memory of object, but associates feel of object with shaking.

37-48 wks. Object sounded, after previous manipulation, occasionally able to reach to it.
Reaches where last had contact with object.
Object sounded, without previous manipulation, see grasp motion but no search.
Protests removal of object.
Examines tactually and reorients. Discriminates and shows preference.
When toy withdrawn, hand follows.

Attributes beginning of reach to sound as convergence of recognition of sound of familiar toy and tactile-motor memory. Search coincides with examining scheme and object has qualities of its own.

49 wks. Reaches to sound cue alone.
Begins to move into space to sound and develops space map.

VISUAL FIXATION
Record of Probes

Name: J.S.

OBJECTIVE	ADMIN.	CRITERIA	FREQ.	TRIALS						DESCRIPTIVE COMMENTS
				Date	Stim.	Latency, Sec.	Duration 1st, Sec.	Freq. Fix. in Trial	R, L, B	
Visual fixation, 15 sec. trial, latency < 5 sec. duration 1st fixation 1-3 sec.+	In Bobby Mac seat, head centered with cut-out Present visual and sound-visual sti. at mid-line, focal distance 6-8".	Pupil reflections, eye(s) 5/5, 3 wk. in a row.	5X	9/19	V bear	1"	1"	several	L → B	
					VS bear	1"	1"	few	L	startled and lost
					V red Legg	< 1"	2"	several	L	Note: Alternate exotropia--though still favors left eye, may finally get both on stimulus, and beginning to alternate exotropia, rt. eye centering at times.
					VS red ball	2"	2"	few	L → B	
					V mirror	0	0			
					VS rattle	3"	1"	few	L	
				9/24	V lite brite	2"	6"	several	L	
					V checker	3"	3"	several	L → B	
					SV bear	5"	2"	several	L	startle
					V checker	5"	2"	several	L	
					SV bear	3"	7"	several	B	
	Sidelying on rt. side, legs flexed, relax head before presenting. Wait for eyes to free		5X	9/26	V mirror	1"	1"	one only	B	went into extension
					V checker	1"	25"		B	rt. centered more
					V checker	2"	30"		B alt.	fix. Rt. & Lt.
					V colored pattern	2"	1"	one only	B	startled
					V red Legg	1"	5"	several	B	sl. exotropia rt.

FIGURE 1

VISUAL TRACKING
Record of Probes

Name: J.S.

OBJECTIVE	ADMIN.	CRITERIA	FREQ.	TRIALS											DESCRIPTIVE COMMENTS
				Date	Stim.	R,L,B	OP/OCP	Dir	Few°	<90°	90°	>90°	90°R	180°	
Tracks with ocular or oculo-cephalic pursuit, partial arc (<90°) to visual or sound-visual stimulus, using both eyes. Trial 15 sec. to obtain fixation.	Head centered with cushion in supine tilt or on lap. Present stim. alternating visual and sound visual at mid. and move Rt/Lt.	Both eyes move with stim. and hold it, for criteria of 3/3 3 weeks in succession	3X R 3X L	9/18	SV red ball	-	-	R	-						no vis. fixation
					V pattern	B	OP	L	+						
					V mirror	B.	-	R	-						fixation, no pursuit
					V face	L	OP	L	+						
					V face	-	-	R	-						no vis. fixation
					SV mirror	L	OP	L	+						
					V mirror	L	OCP	L	+						
					SV silver Legg	L	-	R	-						fixation, no pursuit effort, but no success

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Figure 2.

OBJECTIVE SHEET

CHILD'S NAME: C.M. TEACHER: N.F.

DATE	OBJECTIVE	PREREQUISTE SKILLS	DESCRIPTION OF ADMINISTRATION	BEHAVIOR RECORDED	LONG TERM OBJECTIVE	PROBE	DATE
1-17-74	Explore visual fixation to light spectacle.	Positive orienting r. (heart rate) to light slow Pupil r. light. Need to reduce deviation of gaze.	Centering cushion, supine posture Large light souce (covered flashlight or Lite Brite) 15 sec. trial.	Latency Time + - ? R, L, B 5 trials 1x week.	Unknown potential for functional vision. Visual Fixation 15 sec.	Count duration. Response other stimuli.	
1-17-74	Localizes sound by turning eyes to side within 15 sec.	Quiets to sounds. Mobility of eyes, reduce deviation.	Centering cushion, supine. Explore tilt up later. Vary sounds and voice. Few in, lateral and out of sight. Consecutive. 15 sec. trial.	Stimulus used Latency time. R or L + or - OP (Eyes only) OCP (Eyes and Head 5 trials 1x week.	Localizes and visually identifies source of sound. Meaning for sounds.	Turns eyes and head to side.	
1-17-74	Moves arm to repeat sound spectacle.	Hearing. Limb Movement.	Position supine, pillow, slight head turn. 5 min. baseline 5 min. with tie from wrist to windchimes. Use gross extension movement. Try both arms.	No. extension movements during baseline and with contingent sound whether or not makes sound. R or L.	Batting and eventual reach.	Placement near hand, contact but no tie. Beginning look.	

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Figure 3

OBJECTIVE	CRITERION BEHAVIOR	DATE	RESPONSE	DATE	RESPONSE	DATE	RESPONSE	DATE	RESPONSE	DATE	RESPO
Vis. Fix.	4/5 trials 2 wk.	1-17	Lite - Brite 1. ? 14 B 2. ? 10 R 3. ? 7 B 4. ? 9 B 5. -	1-23 Much more defin-ite	Lite - Brite 1. +5 R 1sec. 2. +5 B<1sec. 3. +4 B<1sec. 4. +6 R<1sec. 5. +5 B 1sec.	1-30	Goal: Latency 4 Duration1-3 1. +5 R<1sec. 2. +4 R 1 sec. 3. +3 B 2sec. 4. +5 B 1sec. 5. +6 B<1sec.		Begin using probe sheet for careful analysis.		
Sound Loc.	4/5 R & L 2 weeks.	1-17	Rt. side 1. - rattle 2. - squeaker 3. +13 voice oc 4. +11 oc. voice 5. +14 oc - bell	1-23	Rt. side 1. - rattle 2. - rattle 3. + 10 oc. voice 4. +8 oc.bell 5. - music b.	1-23	Rt. side 1. +8 oc. voice 2. +6 oc. voice 3. - rattle 4. - rattle 5. +9 bell		Probe a more upright position ?Hearing		
			Lt. side 1. +4 oc, rattle 2. + 12 oc. squeak 3. +10 oc. voice 4.- 5. + 5 oc voice		Lt. side 1. +5 oc. voice. 2. - squeaker 3. +4 oc. bell 4. - 5. +5 bell		Lt. side 1. +5 oc bell 2. +4 oc voice 3. +4 oc voice 4. +6 oc rattle 5. +5 oc bell				
1-17-74 53	Increased frequency and prompt systematic movements.	1-17 Basal 5 min with 5 min	Bil. Bil.								54

Figure 3 (cont.)

SCHEME ASSESSMENT

	Scheme	rattle	necklace	car	doll	doll shoe	rubber bands	bell	paper	cup
SIMPLE SCHEMES - INCORPORATES OBJECTS	1. holds object over 30 sec.									
	2. brings object to mouth									
	3. brings object before eyes or holds object & looks at it									
	4. holds object & looks around rm.									
	5. hits object with hands									
	6. hits object on surface									
	7. hits 2 objects together									
	8. holds and bangs on other palm									
	9. shakes or waves object									
	10. alternate transfer									
COMPLEX SCHEMES BASED ON PROPERTIES OF OBJECTS	11. examines object visually/manually									
	12. examines object manually or mouth									
	13. pushes object									
	14. rolls object									
	15. pats object gently									
	16. brings to ear									
	17. slides object									
	18. crumples object									
	19. stretches object out									
	20. attempts to tear									
	21. drops object systematically									
	22. throws object									
SOCIAL	23. shows object to another person									
	24. functional use of object									
	25. names object or related word									

Figure 4